LONDON-WEST MIDLANDS ENVIRONMENTAL STATEMENT

Volume 5 | Technical Appendices

CFA21 | Drayton Bassett, Hints and Weeford

Survey reports (CH-004-021)

Cultural heritage

November 2013

ES 3.5.2.21.7

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Appendix CH-004-021

Environmental topic:	Cultural heritage	CH
Appendix name:	Survey report	004
Community forum area:	Drayton Basset, Hints and Weeford	021

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1 Introduction

1.1 Structure of the cultural heritage appendices

1.1.1 The cultural heritage appendices for the Drayton Basset, Hints and Weeford CFA (CFA21) comprise:

- Appendix CH-001-021 – Baseline Report;
- Appendix CH-002-021 – Gazetteer of Heritage Assets;
- Appendix CH-003-021 – Impact assessment table; and
- Appendix CH-004-021 – Survey reports (this appendix).

1.1.2 Maps referred to throughout the cultural heritage appendices are contained in the Volume 5 cultural heritage map book.

1.2 Surveys undertaken

1.2.1 This appendix contains the results of extensive archaeological surveys undertaken. Key surveys reported in this appendix include:

- LiDAR survey of the majority of the land required, temporarily and permanently, to construct the Proposed Scheme plus 500m;
- hyperspectral survey of the majority of the land required, temporarily and permanently, to construct the Proposed Scheme plus 500m; and
- geophysical surveys at 3 locations along the route (CN038, CN040 and CN043) encompassing 1.96, 5.5 and 10.1 hectares respectively.

1.2.2 The results of aerial photographic analysis have been incorporated into the baseline report in Appendix CH-001-021 and are not reported separately for this CFA.

2 LiDAR and hyperspectral survey report

2.1 Introduction

2.1.1 The Drayton Basset, Hints and Weeford CFA (CFA21) extends from Drayton Basset in the south to Whittington Heath in the North, and comprises largely rural landscape, stretching for some 8.1 km on a roughly north to south alignment.

2.2 Methodology and limitations of analysis

LiDAR data

2.2.1 The filtered LiDAR data was used to create a Digital Terrain Model (DTM), and analysed in the GIS as three rasters comprising elevation data, a hillshade map and a slope map. Similarly, the unfiltered LiDAR data was used to create a Digital Surface Model (DSM) also analysed as elevation data, a hillshade map and a slope map.

2.2.2 Both the DTM and DSM were viewed as rasters in an ARCView GIS project. All identified features were digitised in the GIS from these rasters.

Hyperspectral data

2.2.3 The hyperspectral data was supplied as a series of ENVI DAT raster files, divided into 22 different sections (runs) covering the area of interest (CFAs 16 – 22). Each ENVI DAT contained 34 bands, representing a portion of the electromagnetic spectrum which included visible light and the near-infrared range. The data had a horizontal cell resolution of 1m.

2.2.4 A number of ArcGIS 10's out-of-the-box tools were used to extract, process and analyse the data. Initially, the ENVI DAT files were imported into a mosaic dataset stored within an ArcGIS 10 file geodatabase. A single combined raster dataset, containing the 34 bands, was created from the mosaic dataset.

2.2.5 As no more than three bands can be viewed at once using ArcMap (the red, green and blue bands of the raster dataset) there is a requirement to investigate subsets of the hyperspectral dataset. Particular attention was paid to the near-infrared and the visible red parts of the electromagnetic spectrum, due to the recognised potential of these in helping to highlight archaeological features (Parcak 2009, 101-2). The near-infrared range (760nm to 900nm on the electromagnetic spectrum) covered bands 6 to 13 in the hyperspectral dataset. The visible red range (605nm to 690nm on the electromagnetic spectrum) covered bands 18 to 22 in the hyperspectral dataset.

2.2.6 The near-infrared and visible red bands were extracted from the combined raster dataset, allowing for these bands to be viewed in isolation. Principal Component Analysis was also carried out on these bands using ArcGIS 10's Principal Components tool. The extracted bands were used to generate a series of single output raster datasets for both the near near-infrared and visible red hyperspectral data; this included a single principal component layer dataset and a multiple principal component layer dataset for both ranges. Different principal component layers could then be assigned to the red, green and blue bands of the multiple principal component layers raster datasets.

Digitising

2.2.7 All feature identification was undertaken manually and compared to the results of available aerial photograph evidence. Both hyperspectral and LiDAR plots were examined in detail and features and areas of likely archaeological potential were digitised manually using ArcGIS 10. These features can be seen in Table 1 below. Archaeological features have been assigned a unique WA number, and are briefly described. Where possible broad dates have been suggested based on the form of the features, and the identification of the features has been assigned a confidence rating (based on a simple five point scale (Low, Low to Moderate, Moderate, Moderate to High and High). Where possible, similar features with a common distribution (e.g. former field boundaries or ponds within a coherent area) have been grouped together.

Limitations

2.2.8 The LiDAR data used in the Study was largely confined to the land required, temporarily and permanently, to construct the Proposed Scheme, with very little coverage of the wider 500m study area. As a result of this the majority of the sites identified lie within the land required, temporarily and permanently, to construct the Proposed Scheme. It should also be added that there were some areas where the LiDAR data provided did not extend across the entire area of the land required, temporarily and permanently, to construct the Proposed Scheme, notably in the area around the A5 and at the very southern end of the section, where the data does not extend as far as the boundary of the land required, temporarily and permanently, to construct the Proposed Scheme.

2.2.9 Much of this stretch of the route is rural, and given over to farmland. Unfortunately, one result of this is that the DSM was less useful than expected as an interpretative tool, as the LiDAR seems to have been flown whilst the crops were fairly well developed. The main result of this is that these crops mask the underlying terrain on the DSM, reducing its effectiveness as an interpretative tool.

2.2.10 The DTM provides a model of the underlying terrain, stripping away crops and trees. As such it was particularly useful in allowing analysis of areas under trees or woodland. However, even on the DTM, in some areas, low lying ground crops or piles or other obstructions have limited the effectiveness of the LiDAR, with the result that, in a few cases, the ground modelling is far from clear.

2.2.11 The horizontal cell resolution of the data also restricted the identification of smaller features (1m intervals) is also likely to have influenced the visibility of small archaeological features and lessened the clarity of some of the larger features.

2.2.12 The effectiveness of hyperspectral data in identifying archaeology can be significantly influenced by a number of factors, including the nature of the underlying geology, the water content of the ground and the type of ground cover. Significant areas of the route studied lie within dense woodland, where there is no likelihood of features being recognised through analysis of hyperspectral data, or beneath cereal crops, where the identification of features is likely to vary. It also suffers from the same limitations as the LiDAR data in built up areas. Because of these variations, other techniques used for identifying areas of archaeological potential (notably the Normalised Vegetation Data Index (NVDI) and the Water Band Index) were not examined in detail.

2.2.13 The Hyperspectral data used in the Study was largely confined to the land required, temporarily and permanently, to construct the Proposed Scheme, with very little coverage of the wider 500m study area. As a result of this the majority of the sites identified lie within the land required, temporarily and permanently, to construct the Proposed Scheme. It should also be added that there were some areas where the Hyperspectral data provided did not extend across the entire area of the land required, temporarily and permanently, to construct the Proposed Scheme, notably around the A5 and at the very southern end of the CFA..

2.2.14 Despite these limitations, it is considered that the available LiDAR and Hyperspectral data provides fairly comprehensive coverage of the land required, temporarily and permanently, to construct the Proposed Scheme. Very little of the 500m study area could be assessed however.

2.3 Results

2.3.1 A total of thirty four sites were identified on the hyperspectral and LiDAR plots within Community Forum Area 21. The bulk of these were identified on the LiDAR plots, with a smaller number also visible on the Hyperspectral imagery. Many appear on both. These are listed in Table 1 below.

2.3.2 The bulk of the sites identified comprise former field boundaries visible as low earthworks or extant ponds or hollows likely to represent the remains of ponds or quarries. These often occur close to field boundaries and are likely to have been used to water livestock, although their original function may have been as quarries. It is thought that the majority are likely to be post-medieval or modern in date as they appear to represent former elements of the current field system, although some may be medieval in origin.

2.3.3 Perhaps surprisingly, there is little evidence here for the extensive areas of ridge and furrow ploughing which characterise much of the medieval and early post-medieval agricultural landscape of the Midlands. Only one small area of remnant ridge and furrow agriculture was identified along this stretch of the route (WA21.25, see Figure 1).

2.3.4 There are a number of features along the line of Bourne Brook which may represent ponds and associated leats (notably WA21.28, see Figure 2). These may represent the remains of millponds or fishponds or both. Clearly the stream was an important source of water and probably power. Two former channels (WA21.27 and WA21.29), one a probable former oxbow of Bourne Brook (see Figure 3), have also been identified. Both are likely to have been natural in origin.

2.3.5 The only other features of note recorded are a series of likely linear and curvilinear anomalies at the southern end of the route (WA21.1, see Figure 4) and a small undated sub rectangular enclosure noted on the southern slopes of Roundhill (WA21.24, see Figure 5).

2.4 Summary

2.4.1 In general, the sites identified are dominated by former field boundaries and quarries/ponds, all likely to be linked to post-medieval and modern agriculture. The Bourne Brook appears to have been used as a source of water and power feeding a series of millponds or fishponds, probably in the medieval, post-medieval and modern periods. Two former watercourses might also have acted as foci for human activity. A small sub-rectangular enclosure of unknown date has been identified on the southern slopes of Roundhill.

2.5 References

Parcak, S, H,. 2009. Satellite Remote Sensing for Archaeology. Routledge, Abingdon.

2.6 Figures

Figure 1: Site WA 21.25. Traces of ridge and furrow (green) to the North West of Brock Hurst (Hyperspectral Band 10 – Wavelength 828.050 nm)

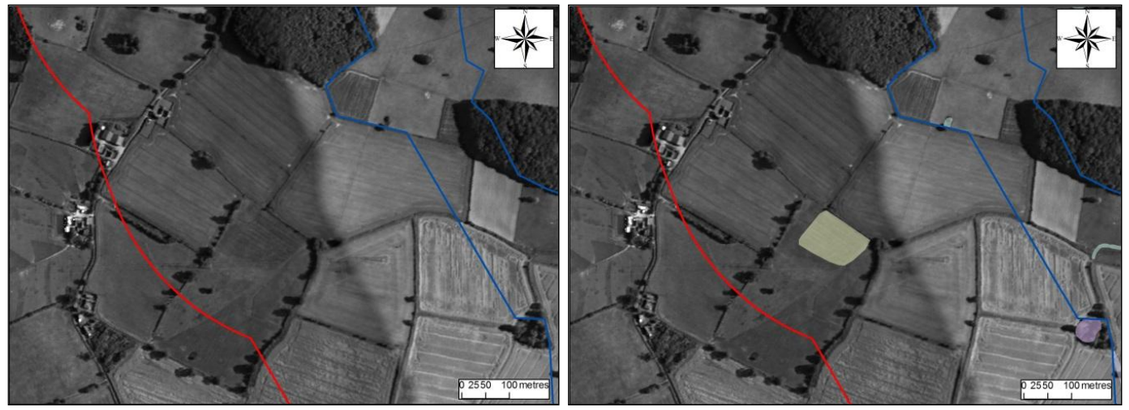


Figure 2: Site WA 21.28. Ponds and leats to the west of Hints (blue) on LiDAR plot.

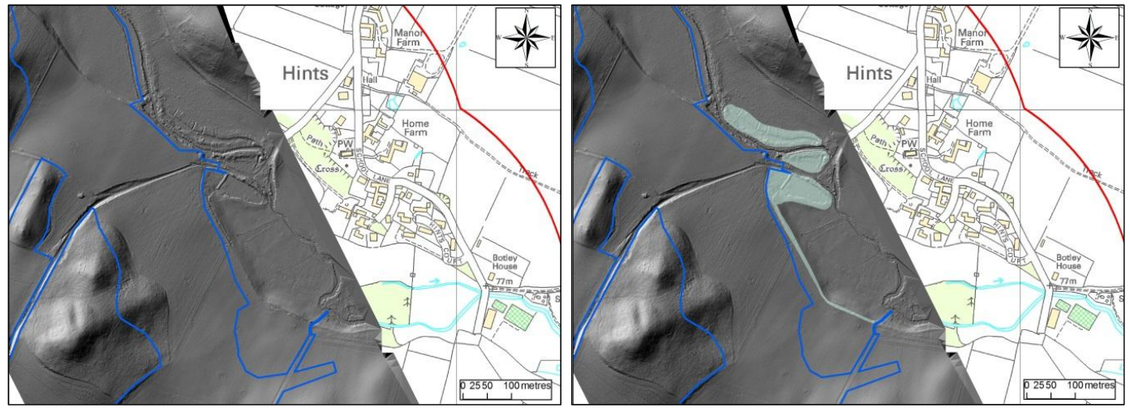


Figure 3: Sites WA21.29 and WA21.30. Former channel (pink) and pond and leat (blue) to the south east of Bourne House on LiDAR plot.

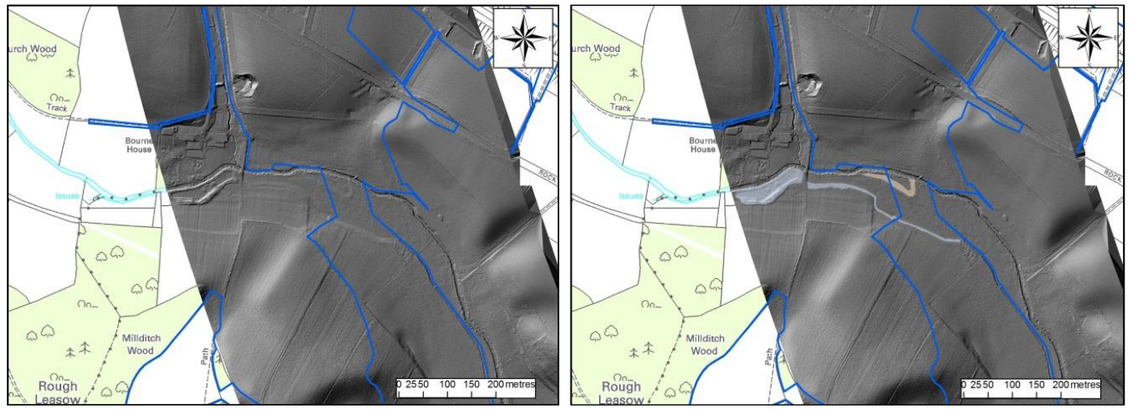


Figure 4: Site WA 21.1. Linear anomalies (pink) likely to belong to earlier enclosure or boundary system (Hyperspectral Band 10 – Wavelength 828.050 nm).

Figure 5: Site WA 21.24. Enclosure on the slopes of Roundhill (yellow) on LiDAR plot.

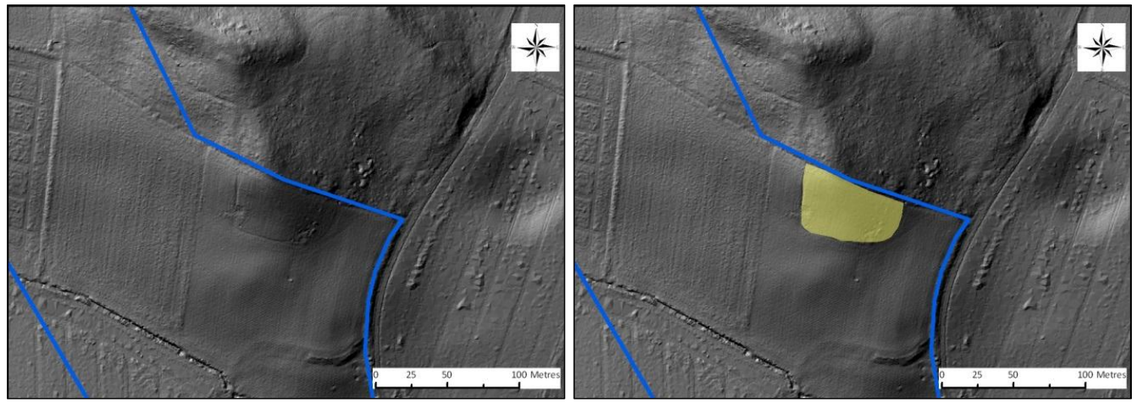


Figure 6: Anomalies within CFA21

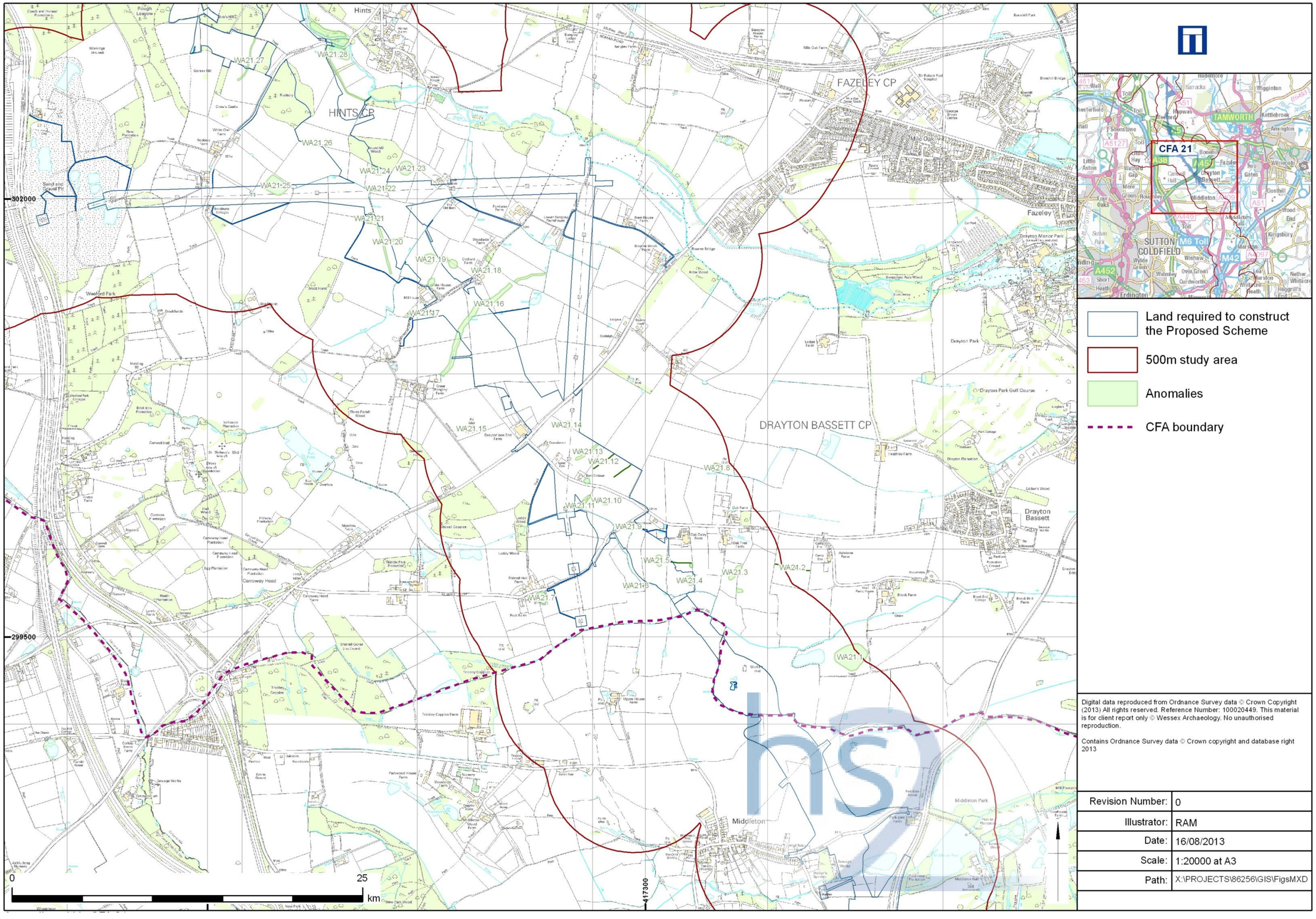
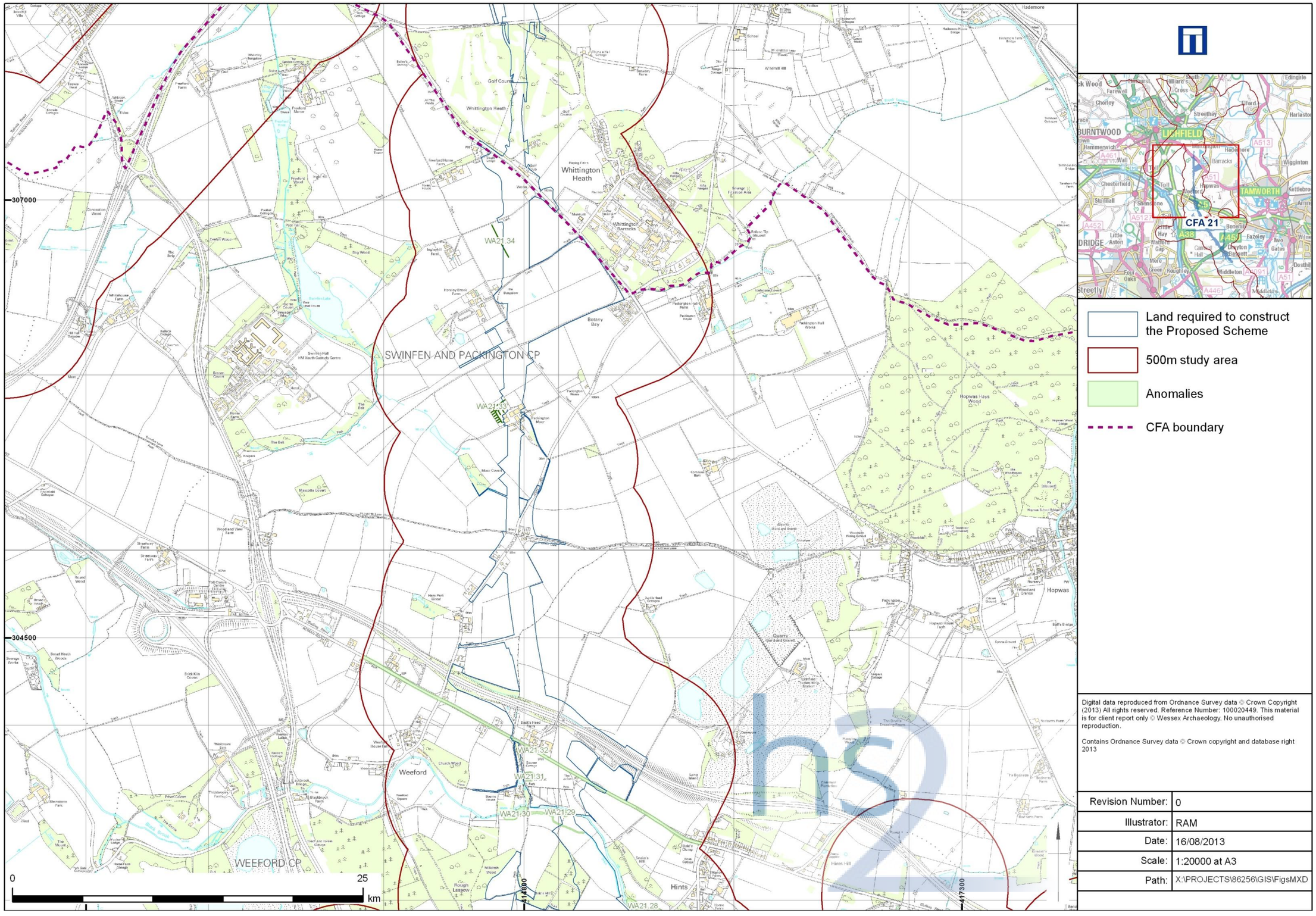


Figure 7: Anomalies within CFA21



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2.7 Identified Sites

Table 1: Sites within CFA21

No	Site	Eastings	Northings	Description	Date	Confidence rating
WA21.1	SW of Brook Farm	418470	299375	Series of linear and curvilinear anomalies possible enclosure or field boundaries. Visible on Hyperspectral plots	Undated	Low
WA21.2	SE and SW of Oak Tree Farm	418140	299893	Linear earthworks aligned broadly west – east. Possible former field boundaries. Visible on LiDAR plots.	Undated	Moderate to high
WA21.3	SE of Oak Tree Farm	417820	299810	Two large hollows. Probably the remains of quarries or pond. Visible on LiDAR plots.	Undated	Moderate to high
WA21.4	S of Oak Dairy Farm	417560	299870	2 Ponds. Probably man made. Possibly former quarries. Visible on both Hyperspectral and LiDAR plots.	Post-medieval/ modern	Moderate to high
WA21.5	SW of Oak Dairy Farm	417375	299235	Large hollow. Probably the remains of a quarry or pond	Undated	Moderate to high
WA21.6	E of Shirral Hall Farm	417245	299793	Linear earthwork aligned broadly west – east. Possible former field boundary. Visible on LiDAR plots.	Post-medieval/ modern	Moderate to high
WA21.7	E of Shirral Hall Farm	416700	299720	Pond. Man made. Possibly a former quarry. Visible on LiDAR plots	Post-medieval/ modern	Moderate to high
WA21.8	NNW of Barn Cottage	417710	300460	Pond, divided into two unequal cells. Man made. Visible on LiDAR plots	Post-medieval/ modern	Moderate to high
WA21.9	West of Oak Dairy Farm	417210	300130	Large irregular hollow of uncertain origin adjacent to the road. Visible on LiDAR plots	undated	Low
WA21.10	SE of Barn Cottage	417070	300265	Large hollow, possibly a former pond or quarry. Probably man made. Visible on LiDAR plots	Undated	Moderate to high
WA21.11	SE of Barn Cottage	416965	300390	2 Ponds. Probably man made. Possibly a former quarry. Visible on LiDAR plots	Post-medieval/ modern	Moderate to high
WA21.12	NE of Barn Cottage	417125	300480	Possible lynchets. Low linear earthworks aligned broadly north east – southwest. These may represent possible lynchets. Neither can be traced into the field to the north east. Visible on LiDAR plots	Medieval/post-medieval	Moderate
WA21.13	N of Barn Cottage	416970	300550	Linear earthwork. Low linear earthwork aligned broadly north east – southwest. Possible former field boundary. Cannot be traced into the field to the north east. Visible on LiDAR plots	Post-medieval/ modern	Moderate to high
WA21.14	E of Draytonlane Farm	416850	300710	Pond. Probably man made. Visible on LiDAR plots	Post-medieval/ modern?	High
WA21.15	W of Draytonlane Farm	416310	300685	Pond. Probably man made. Visible on LiDAR plots	Post-medieval/ modern?	High
WA21.16	ESE of White House Farm	416260	301280	Former watercourse lies in shallow valley. Still exists as a ditch for part of its course. Visible on both Hyperspectral and LiDAR plots. Visible on LiDAR plots	Undated	High
WA21.17	South of White House Farm	416000	301625	Two ponds. These appear to have been man made. Visible on LiDAR plots	Post-medieval/ modern	Moderate to high
WA21.18	NE of Orchard Farm	416400	301625	Two ponds. These appear to have been man made. Visible on LiDAR plots	Post-medieval/ modern	Moderate to high
WA21.19	W of Woodside Farm	416150	301650	Group of four large hollows, three of which coincide with field boundaries. Probably the remains of small quarries or ponds. Visible on LiDAR plots	Undated	Moderate to high
WA21.20	S of Roundhill Wood	415780	302060	Former field boundary. Curving line of former boundary comprising the remains of a ditch and probable hedge bank	Post-medieval/ modern	Moderate to high
WA21.21	S of Roundhill Wood	415720	301885	Pond. Roughly oval pond on boundary between two fields. Visible on LiDAR plots	Post-medieval/ modern	Moderate to high
WA21.22	S of Roundhill Wood	415780	302060	Former field boundary. Curving line of former boundary comprising the remains of a ditch and probable hedge bank. Visible on LiDAR plots	Post-medieval/ modern	High
WA21.23	SE of Roundhill Wood	415935	302175	Large sub-circular hollow just to the SE of the hill. Possibly a former pond/quarry. Visible on LiDAR plots	Undated	Moderate to high
WA21.24	S of Roundhill Wood	415760	302155	Small sub rectangular enclosure on southern slopes of hill. Visible on LiDAR plots	Undated	High
WA21.25	NW of Brock Hurst	415180	302070	Small area of surviving ridge and furrow at NE end of large rectangular field.	Post-medieval/ modern	Moderate to high
WA21.26	SW of Roundhill Wood	415430	302320	Pond. Roughly oval pond on boundary between two fields. Visible on LiDAR plots	Post-medieval/ modern	Moderate to high
WA21.27	W of Rookery Wood	415050	302870	Former watercourse. Shallow meandering linear, probably fed by a former or seasonal spring. Visible on LiDAR plots.	Undated	High
WA21.28	SW of Hints	415530	302900	Series of ponds, associated earthworks and a leat. Two ponds, one on either side of road, with a leat leading to the south east, where it re-joins the river. Possibly a series of linked mill ponds, or fish ponds. Visible on LiDAR plots.	Post-medieval	High
WA21.29	SE of Bourne House	415010	303500	Former channel. Probable oxbow from earlier course of the river. Visible on LiDAR plots.	Undated	Moderate to high
WA21.30	SE of Bourne House	414840	303500	Large irregular pond to the west of the road. Former mill pond/fish pond?. Line of infilled leat/water channel is clearly visible. Visible on LiDAR plots.	Post-medieval	High
WA21.31	NE of Bourne House	414830	303700	Quarry lies adjacent to road. Visible on both Hyperspectral and LiDAR plots.	Post-medieval	High

No	Site	Eastings	Northings	Description	Date	Confidence rating
WA21.32	NE of Weeford	415020	303758	Line of Roman road. Visible on both Hyperspectral and LiDAR plots.	Roman	High
WA21.33	NW of Packington Moor Farm	414655	303800	Series of small regular rectangular earthworks in the field to the north west of the farm complex. Probably modern paddocks or small fields. Visible on LiDAR plots.	Post-medieval/ modern?	Moderate to high
WA21.34	E of Horsley Brook Farm	414663	306765	Low linear earthwork. Probably the line of a former hedgeline or field boundary. Visible on LiDAR plots.	Post-medieval/ modern?	High

3 Geophysical surveys

3.1 CN038 Land off Sutton Road (A429), near Drayton Bassett, Staffordshire

Introduction

Project Background

3.1.1 Wessex Archaeology was commissioned by Atkins, on the behalf of HS2, to carry out a geophysical survey of area CN038 off Sutton Road (A453), near Drayton Bassett, Staffordshire (Figure 8), hereafter "the Site" (centred on NGR 416880 300320). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.

3.1.2 This Site, CN038, was selected for geophysical survey as it is located within the former Shirral Park Deer Park at the northern boundary and has the potential to detect archaeological remains associated with the deer park and subsequently with the estate of Drayton Park Manor located 2km to the east of the Site.

Site details

3.1.3 The Site comprises one field located off Sutton Road (A453) and lies approximately 2km west of the centre of Drayton Bassett. The limits of the geophysical survey area are defined by modern field boundaries for much of the area with the southern limits defined by the client. To the north of the survey area is a road and to the east is a small area of wood separating this field from the adjacent one. The Site comprises one field under a young cereal crop. Geophysical survey was undertaken over the field with no area lost to obstructions, however two parallel strips of land in the survey area each approximately10m wide have been affected by the path of an overhead pylon. The area of data coverage came to around 2.5ha.

3.1.4 The Site lies on an area of gently sloping land that falls away towards the southeast. The northwest region of the survey area lies at a height a little over 110m aOD (above Ordnance Datum) and falls from this height to less than 105m aOD at the southeast corner of the Site.

3.1.5 The solid geology is recorded as Keuper Marl sandstone with Rhaetic and Dolomitic conglomerate (Triassic) (Ordnance Survey 1957) with superficial deposits of Boulder Clay and Morainic Drift (Quaternary) (Ordnance Survey 1977).

3.1.6 The soils underlying the Site are likely to be typical stagnogley soils of the 711n (Clifton) association with small deposits of stagnogleyic argillic brown earths of the 572e (Whimple 3) association (SSEW 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

Archaeological Background

3.1.7 For a detailed assessment of the known archaeology of the Site and surrounding area Appendix CH-001-021 should be consulted. A summary of the available archaeological records has been provided here for reference with the results and interpretation of the geophysical survey.

3.1.8 The Site lies within the northern side of the bounded area of Shirral Park. It is a deer park mentioned on a late 15th century account roll for Drayton Manor, and was one of three parks and warrens in the manor of Drayton in 1505. The park is recorded to have covered circa 443 acres in the 16th century. It was disparked in 1756 and there is now no visible trace of an earthwork boundary which would have surrounded the park (MST4006).

3.1.9 Within Shirral Park deer park are a further four records. In the field to the west of the Site is a recorded findspot of medieval pottery sherd recovered during fieldwalking (MST6135). To the southwest of the Site are the remains of a dam along the western edge of Loddy wood, an earthwork bank surviving to c.3m in height with a rectangular brick structure near the northeast corner (MST6134). A curving linear feature identified on aerial photography interpreted as a boundary bank probably represents the former southeastern extent of Shirral coppice, the feature is undated (MST 6148). Finally there is an earthwork bank and ditch aligned east to west through Shirral coppice which appears to be the continuation of a current and extant field boundary (MST 6147).

3.1.10 The area is dominated by records detailing Drayton Manor House and Park and Gardens, approximately 2km to the East of the Site. It was the site of a post-medieval timber-framed mansion building, which was demolished and replaced by a large country house in the late 18th century. The latter has also now been demolished (MST1124; MST6299). Several other records are located outside of the survey area and include further linear features identified from aerial photographs and interpreted as former field boundaries through to findspots of coins and potsherds recovered through fieldwalking of Prehistoric, Romano-British and Medieval date (MST 6141; MST 6142). The earliest recorded finds are flints interpreted as being Mesolithic to Neolithic in date (MST 6138).

3.1.11 In the field immediately to the north of the Site are located two records. Firstly, extensive cropmarks were observed in RAF aerial photographs forming adjoining enclosures with possible ditched roadways, and are interpreted as possibly a former field system. Although the form these undertook is not detailed they were interpreted as a possible Iron Age field system (ID306718 and MST3403). The second record describes a World War II searchlight battery which was positioned here and would have possibly taken the form of a ring ditch feature (ID 1521656).

Methodology

Survey Objectives

3.1.12 A Written Scheme of Investigation (WSI) was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed (Wessex Archaeology 2013). The stated aims include the following:

- to conduct a detailed survey which covers as much of the specified area as possible, allowing for artificial obstructions;
- to clarify the presence/absence and extent of any buried archaeological remains within the site; and
- to determine the general nature of the remains present.

3.1.13 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.

Survey Dates

3.1.14 A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team on 23rd May 2013.

Grid Location

3.1.15 The individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (EH 2008).

3.1.16 A representative sample of survey grid nodes (around 10%) were re-surveyed in the mornings in the event they were left out in the field overnight. This was undertaken along with a visual inspection of entire lines of grid nodes to ensure the survey grid remained accurate for the entire survey.

Instruments Used and Survey Method

3.1.17 The magnetometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data were collected at 0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT, in accordance with EH guidelines (EH 2008).

3.1.18 Data were collected in the zigzag method with grids oriented north to south (Grid North). The first direction walked for each grid was heading towards the north.

Data Processing

3.1.19 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function (±7nT thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey data, with no interpolation applied.

3.1.20 Further details of the geophysical and survey equipment, methods and processing are described in Appendix 1.

Data Presentation

3.1.21 The processed gradiometer data were output as .png image files and georeferenced in CAD (AutoCAD Map 3D 2011); these images were exported as georeferenced .png image files (accompanied by .pgw files). The interpretation layers were digitised in CAD and the resulting interpretation layers were exported as ESRI shapefiles, in accordance with the specification. The data images and interpretation shapefiles were then passed to our graphics team who produced the final figures in GIS (ESRI ArcMap 10).

3.1.22 The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ±25nT at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:1250.

Results

Introduction

3.1.23 The gradiometer survey has been successful in identifying anomalies of likely and possible archaeological interest, along with numerous trends. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1250 (Figure 9 to Figure 11).

3.1.24 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Figure 11). Full definitions of the interpretation terms used in this report are provided in Appendix 2.

3.1.25 Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

Interpretation: Archaeology

3.1.26 The greatest concentration of potential archaeological features lies towards the western end of the Site. Most of these anomalies have very weak magnetic values with typical values less than +2nT, this weak contrast suggests that many more features may be present than are visible in the geophysical data.

3.1.27 At 4000 is a discrete but intermittent anomaly trending north-west to south-east parallel with the current field boundary and the orientation of the road and extends for approximately 90m. One small discrete positive anomaly along the length of the larger anomaly has been identified and interpreted as archaeology along with several smaller discrete areas interpreted as possibly archaeological in origin. Further to this weak response linear trends along the intermittent length of the anomaly have been tentatively identified as agricultural – ploughing trends. The anomaly is located in the northern boundary area of Shirral Park Deer Park where there is the potential for a former earthwork boundary delimiting the park but this anomaly is also in the same orientation as the current field boundary and there is the possibility that ploughing routes or tracks are also in the same orientation therefore it has been interpreted as possible archaeology with ploughing trends with only one area along it defined as archaeology.

3.1.28 In the area around 4000 are several linear trends interpreted as agriculture – ploughing and they are orientated north-west to south-east. There are numerous small oval and sub-oval shaped discrete positive anomalies in this area which have been interpreted as possible archaeology and could represent pits.

3.1.29 To the south-east of 4001 are two features, a positive circular anomaly is interpreted as archaeology and could represent a pit and a semi-circular positive anomaly is interpreted as possible archaeology (weak response). This anomaly is larger in shape and if it was an archaeological feature it could represent part of a semi-circular ditch, however it has a very weak magnetic response. Several small circular and sub-oval shaped positive anomalies have been identified as possible archaeology and could represent pits. They do not form a cluster or regular spatial distribution but are scattered randomly throughout the area.

3.1.30 In the western half of this field around 4002 are several discrete linears of increased magnetic response, these are interpreted as ceramic field drains orientated north-west to south-east and spaced approximately 12m apart. There are numerous ploughing trends across the whole of this field that are considered to be relatively modern.

3.1.31 Anomaly 4003 is a large area measuring approximately 80m x 60m with numerous strong dipolar anomalies interpreted as a concentration of ferrous material, possibly modern debris. Through correlation with available aerial images a cropmark is observable at this location corresponding with the size and shape of the area seen here in the data. One small sub-oval

positive anomaly has been identified among the ferrous anomalies and is interpreted as archaeological in origin. It has been described as such due to the uncertain origin of the large area of ferrous material corresponding with an observable cropmark and there are no records at this location to suggest a cause. The sites within the area are predominantly former earthwork field boundaries of which this anomaly does not take the form or characteristics; it could possibly represent a pit type feature.

3.1.32 A large spreading area approximately 60 x 50m around 4004 has been identified as an area of increased magnetic response and within it are numerous dipolar anomalies interpreted overall as a concentration of ferrous material although the anomalies are weaker and more defined compare to those at 4003. Given the concentration of ferrous material identified immediately to the north-west around 4003 an anthropogenic cause, probably modern debris, is considered more likely.

3.1.33 In the eastern half of the field is a second group of ceramic field drains at a different orientation to those around 4002, they are orientated north-east to south-west. This second grouping of field drains survives between two large areas of disturbed ground; 4003 which is an area of numerous ferrous anomalies and 4004 which is an area of increased magnetic response.

3.1.34 At 4006 are one oval and two elongated oval shaped positive anomalies, they are interpreted as possibly archaeology (weak response) and are in amongst an area of ceramic field drains. At the location of 4006 and across the Site are small sub-oval shaped positive anomalies and slightly larger elongated positive anomalies. The larger examples tend to have much weaker magnetic values, and the smaller ones tend to have stronger magnetic values, typically over +2nT. These features are considered to represent cut features such as short sections of ditch and smaller features such as pits and postholes.

3.1.35 The remaining anomalies of interest consist of small, sub-circular or sub-oval shaped positive anomalies and weak linear trends. The small positive anomalies are considered to possibly represent cut features such as small pits and postholes although geological explanations are also possible. The weak trends are considered to either represent ploughing trends set at an angle to the prevailing direction of ploughing or are weak archaeological features. As there is no significant patterning in their spatial distribution they have been classed as possible archaeology (small positive anomalies) and uncertain origin (trends). Some of the smaller, stronger anomalies may prove to be part of small ferrous anomalies that do not have an obvious negative region associated with it. These anomalies have mostly been classed as possible archaeology.

Interpretation: Modern Services

3.1.36 There are no modern services identified in the survey area, however as mentioned above, an overhead electricity pylon crosses the field north to south therefore this disturbance is visible in the data.

3.1.37 At 4005 in the south-west corner of the survey area is a broad area of positive magnetic response, this is in the vicinity of an electricity pylon and is probably attributable to that.

Conclusions

Introduction

3.1.38 The detailed gradiometer survey has been successful in detecting anomalies of likely and possible archaeological interest within the Site, in addition to regions of increased magnetic response, the presence of ceramic field drains across two areas of the Site and numerous trends of uncertain origin.

Discussion

3.1.39 The data shows one archaeological feature that may be associated with records of a possible boundary of a medieval deer park. The anomaly labelled 4000 is considered to be the most relevant to these records. This area could be the location of the former earthwork boundary or the anomalies identified could represent agricultural features associated with post-medieval to modern agricultural practices since it was disemparked.

3.1.40 There are several other likely archaeological features located within the Site, most notably 4001 and 4003, these features are considered to represent pits and a tentatively identified semi-circular ditch but it is unclear as to the period they could date to.

3.1.41 It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be encountered than have been identified through geophysical survey. Given how weak many of the features interpreted in this data are it seems very likely that more features may be present than were detected during the survey.

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Wessex Archaeology, 2013. HS2: Geophysical Survey Written Scheme of Investigation. Report Reference: 86254.01.

HER Records Consulted

MST 1124 – Drayton Manor House.

MST 3403 – & Pastscape Monument No 306718 – Cropmarks; Possible Iron Age field system.

MST 4006 – Shirral Park Deer Park.

MST 6134 – Dam; Earthwork bank; Loddy Wood.

MST 6135 – Findspot; Medieval pottery sherd.

MST 6138 – Findspot; Mesolithic/Neolithic flints.

MST 6141 – Findspot; Prehistoric potsherd.

MST 6142 – Findspot; Romano-British and Medieval coin and potsherds.

MST 6147 – Earthwork bank and ditch; Shirral Coppice.

MST 6148; Boundary bank; curving linear feature.

MST 6299 – Drayton Manor Park and Gardens.

English Heritage PastScape Records

Monument No. 1521646 – Possible site of World War Two searchlight battery no.350 BG09 7.

Figures

Figure 8: Site location

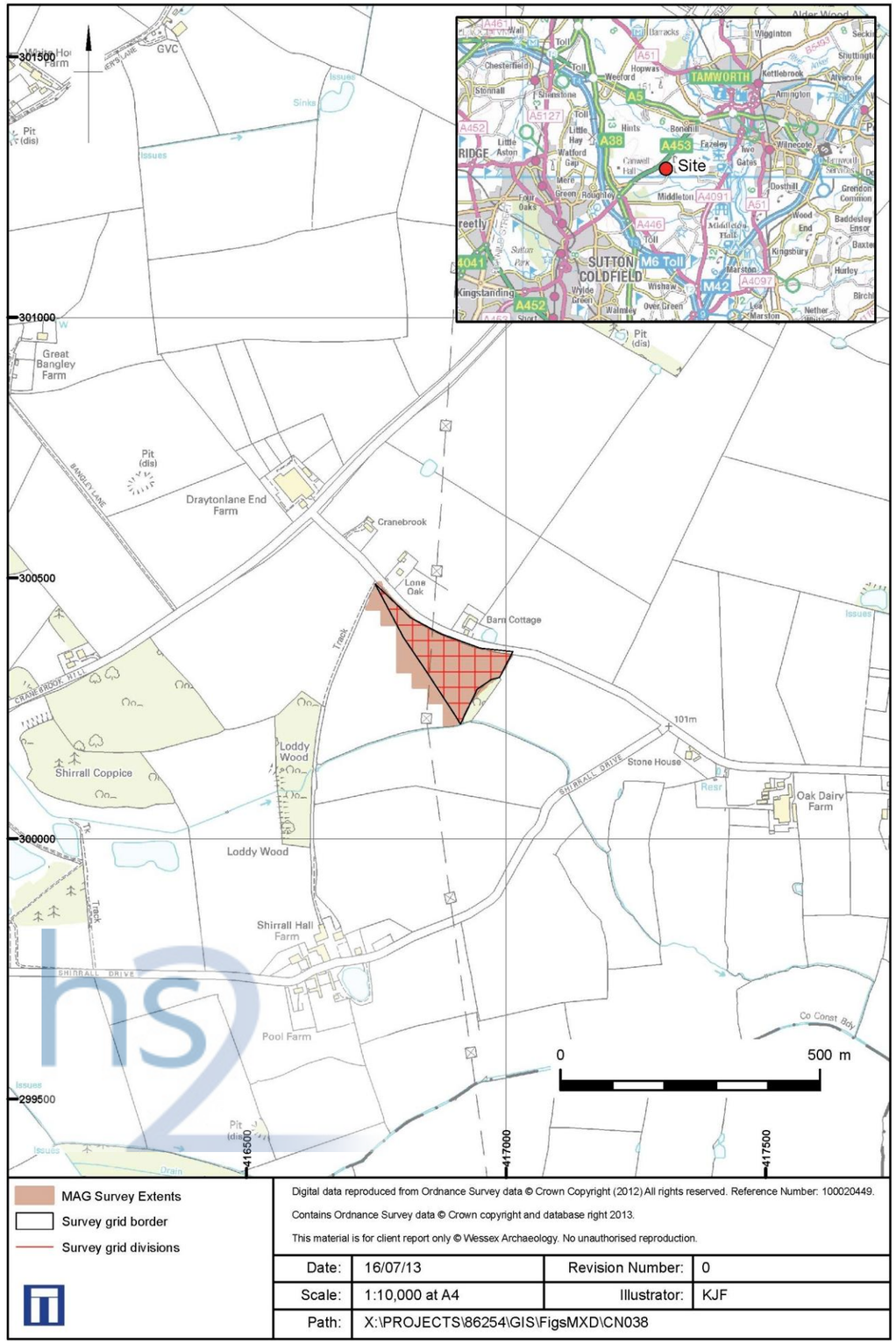

Figure 9: Greyscale plot

Figure 10: XY trace

Figure 11: Interpretation

3.2 CN040 Land off Roman Road, near Weeford, Staffordshire

Introduction

Project Background

3.2.1 Wessex Archaeology was commissioned by Atkins, on the behalf of HS2, to carry out a geophysical survey of area CN040 off the Roman Road, near Weeford, Staffordshire (Figure 12), hereafter "the Site" (centred on NGR 414970 303680). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.

3.2.2 This Site, CN040, was selected for geophysical survey as it is located within an area of archaeological risk with known remains in the vicinity including a Roman road and cropmarks.

3.2.3 For a detailed assessment of the known archaeology of the Site and surrounding area Appendix CH-001-021 should be consulted.

Site Details

3.2.4 The Site is comprised of seven fields immediately south of the Roman Road and lies approximately 0.8km east of the centre of Weeford. The limits of the geophysical survey area are defined by modern field boundaries for the entire site. To the north of the survey area is the Roman road, to the west is a track and to the south is Black Brook. There is also a disused pit on the western boundary of the site.

3.2.5 The Site lies on an area of gently sloping land that falls away towards the south. The northern part of the survey area lies at a height a little over 95m aOD (above Ordnance Datum) and falls from this height to less than 80m aOD at the southern limit of the Site. As much of the proposed area was surveyed, although the southwestern extent beyond the track was not accessible and access had not been secured to the eastern portion of the survey area.

3.2.6 The solid geology is recorded as soft sandstone with pebble beds with grey marls with fire clays and sandstones along the bank of Black Brook (Ordnance Survey 1954). The soils underlying the Site are likely to comprise the typical brown sands of the 551a (Bridgnorth) association and the humo-ferric podzols of the 631e (Goldstone) association closer to the brook (SSEW 1983). Soils in such geological settings have been demonstrated to produce magnetic contrasts suitable for the detection of anomalies through gradiometer survey.

Methodology

Survey Objectives

3.2.7 A Written Scheme of Investigation (WSI) was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed (Wessex Archaeology 2013). The stated aims include the following:

- To conduct a detailed survey which covers as much of the specified area as possible, allowing for artificial obstructions;
- To clarify the presence/absence and extent of any buried archaeological remains within the site;
- To determine the general nature of the remains present.

3.2.8 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.

Survey Dates

3.2.9 A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team on 12th, 13th, 16th and 29th August 2013.

Grid Location

3.2.10 The individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (EH 2008).

3.2.11 A representative sample of survey grid nodes (around 10%) were re-surveyed in the mornings in the event they were left out in the field overnight. This was undertaken along with a visual inspection of entire lines of grid nodes to ensure the survey grid remained accurate for the entire survey.

Instruments Used and Survey Method

3.2.12 The magnetometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data were collected at 0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT, in accordance with EH guidelines (EH 2008).

3.2.13 Data were collected in the zigzag method with grids oriented north to south (Grid North). The first direction walked for each grid was heading towards the north.

Data Processing

3.2.14 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function (up to ±8nT thresholds for high gradients) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey data, with no interpolation applied.

3.2.15 Further details of the geophysical and survey equipment, methods and processing are described in Appendix 1.

Data Presentation

3.2.16 The processed gradiometer data were output as .png image files and georeferenced in CAD (AutoCAD Map 3D 2011); these images were exported as georeferenced .png image files (accompanied by .pgw files). The interpretation layers were digitised in CAD and the resulting interpretation layers were exported as ESRI shapefiles, in accordance with the specification. The data images and interpretation shapefiles were then passed to our graphics team who produced the final figures in GIS (ESRI ArcMap 10).

3.2.17 The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ±25nT at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:2000.

Results

Introduction

3.2.18 The gradiometer survey has been successful in identifying anomalies of likely and possible archaeological interest, along with numerous trends. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:2,000 (Figure 13 to Figure 15).

3.2.19 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Figure 15). Full definitions of the interpretation terms used in this report are provided in Appendix 2.

3.2.20 Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

Interpretation: Archaeology

3.2.21 Near the northern extent of the Site, region of increased magnetic response 4000 lies adjacent to the Roman road and, although the responses are not characteristically archaeological in origin, it is possible that it is associated with archaeological deposits. Magnetic disturbance nearby is assumed to be modern in origin, and it is therefore possible that the increased responses relate to the construction of the road or later dumping.

3.2.22 Region of increased response 4001 extends NW-SE, parallel with the northern boundary and the Roman road. Given the presence of ploughing trends on the same orientation, it is possible that it relates to magnetic deposits being ploughed to the surface, or perhaps a former boundary or ploughing headland.

3.2.23 Clusters of pit-like anomalies 4002, 4003, 4004 and 4005 lie within the northern portion of the northernmost field. These groups have been interpreted as being of possible archaeological interest given the size of some of the individual anomalies and the relative density of their distribution. However, the pit-like responses are unenclosed and their relationships with one another are uncertain.

3.2.24 Towards the southern extent of the northern field, numerous ferrous responses 4006 lie close to strong magnetic disturbance associated with fencing. Several isolated pit-like anomalies are visible, which are considered to be of possible archaeological interest.

3.2.25 In the southwesternmost field, curvilinear ditch-like anomaly 4007 extends approximately E-W across the centre of the field, with a weaker band of increased response immediately to the north, demarked by a pair of trends. It is unclear whether this anomaly relates to a ditch or an agricultural feature, and has consequently been interpreted as being of possible archaeological interest.

3.2.26 At the centre of the southernmost fields, anomalies 4008 appear in close proximity to regions of magnetic disturbance. The extents of ferrous responses associated with the fencing and other sources of disturbance have reduced the confidence with which these anomalies can be interpreted, although they are considered to be of possible archaeological interest.

3.2.27 Immediately to the east, a profusion of sub-linear and pit-like anomalies 4009 lies within an extended region of increased magnetic response. These anomalies are considered to be of possible archaeological interest, as there is a general lack of coherency of form. Their proximity to regions of magnetic disturbance further hampers conclusive interpretation.

3.2.28 Towards the southeastern extent of the survey area, a series of short linear anomalies 4010 is oriented N-S and is consistent with the remnants of a ditch or former boundary. Given the fragmentary nature of these anomalies, it is difficult to ascertain whether they are archaeological in origin, or represent a more recent temporary boundary. To the east, a similar band of anomalies 4011 is oriented NNE-SSW and is similar in character; this cluster is also considered to be of possible archaeological interest.

3.2.29 At the southeasternmost extent of the Site, strong linear anomaly 4012 is oriented NNW-SSE and has been interpreted as being of possible archaeological interest. This is tempered by the presence of magnetic disturbance flanking the anomaly; whilst 4012 is consistent with a ditch, the strength of its response suggests that it may be modern in origin although it lacks characteristics typical of a service. However, an archaeological interpretation cannot be excluded entirely.

3.2.30 Within the northern portion of the survey area, ploughing trends oriented parallel with the Roman road are visible, although there is little indication of former field boundaries. Other trends on different orientations are visible throughout the dataset, although it is difficult to ascertain their archaeological potential.

Conclusions

Introduction

3.2.31 The detailed gradiometer survey has been successful in detecting anomalies of possible archaeological interest within the Site, in addition to regions of increased magnetic response and numerous trends of uncertain origin.

Discussion

3.2.32 A relatively dense cluster of anomalies of possible archaeological interest has been identified within the southernmost portion of the survey area. Whilst these anomalies are not characteristically archaeological in form and extensive magnetic disturbance is evident nearby, it is possible that these responses may be associated with archaeological features.

3.2.33 It is interesting to note the presence of regions of increased magnetic response and clusters of pit-like anomalies in the northern portion of the survey area. It is unclear what relationship, if any, exists between these anomalies and the nearby Roman road; it is conceivable that they are agricultural or natural in origin.

3.2.34 At the southeastern extent of the Site, linear anomaly 4012 is unusual, with strong negative responses flanking its southern extents and weaker negative responses to the northwest. It is possible that it relates to a former boundary although it is not possible to exclude an archaeological interpretation.

References

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Figures

Figure 12: Site location

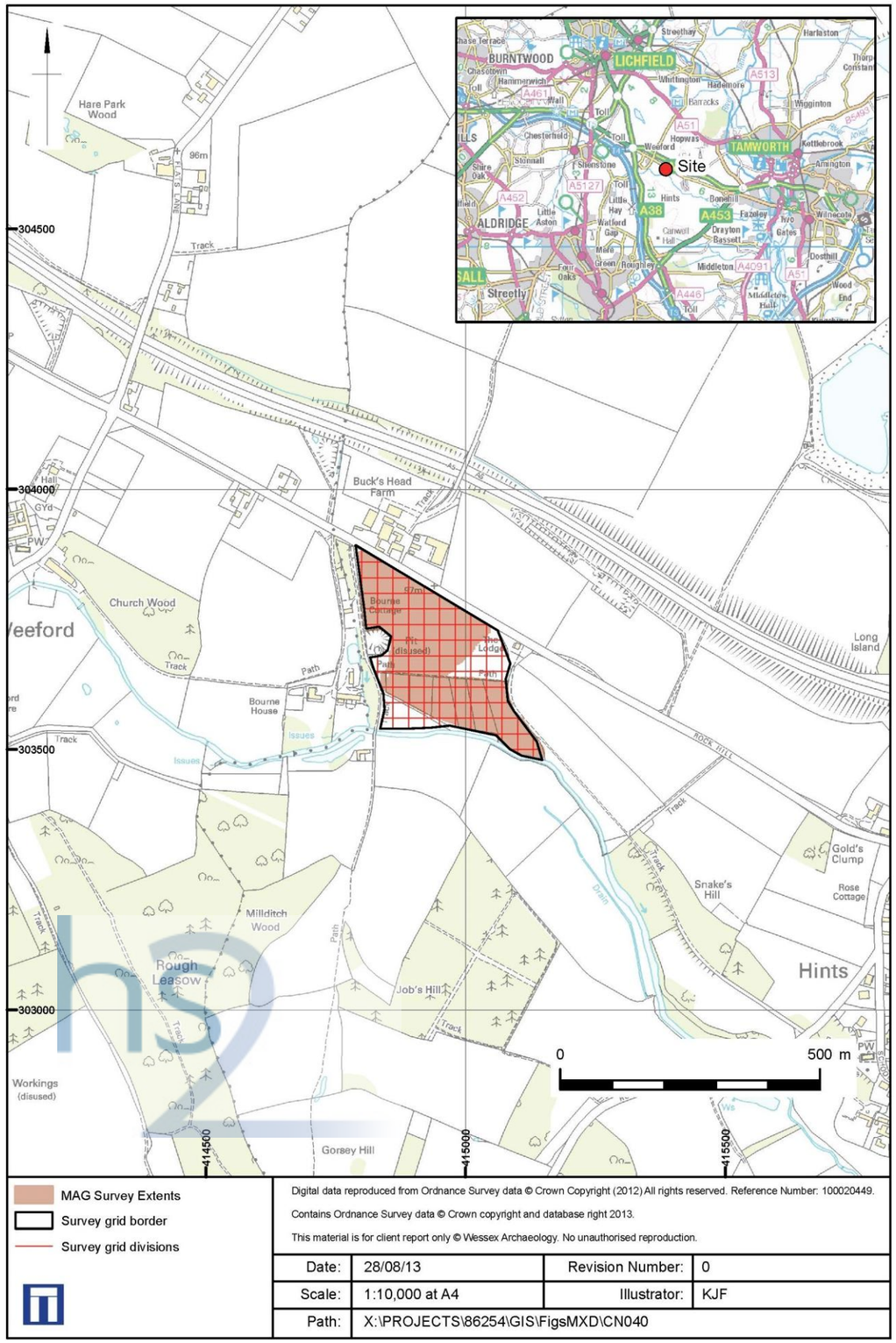


Figure 13: Greyscale plot

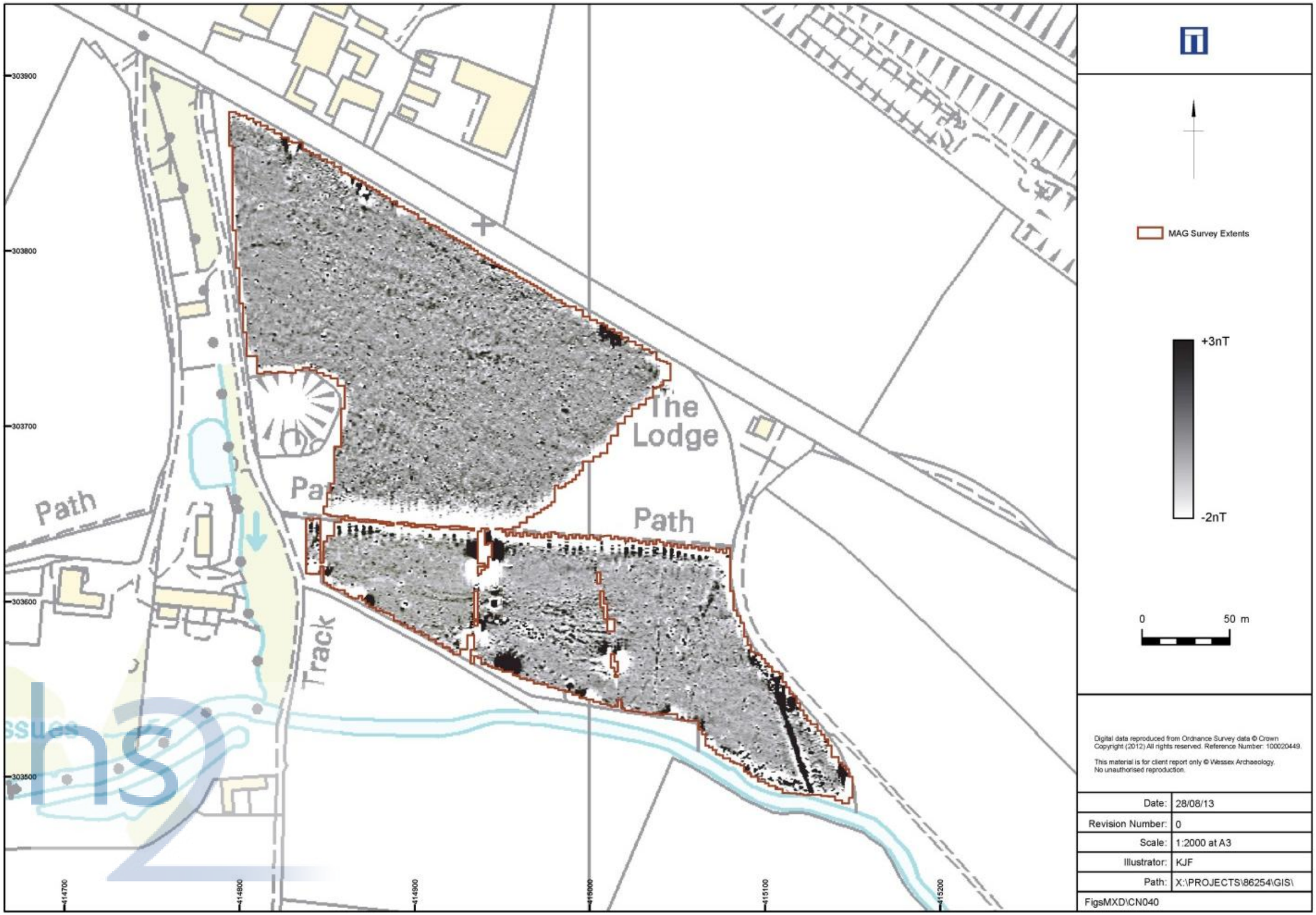
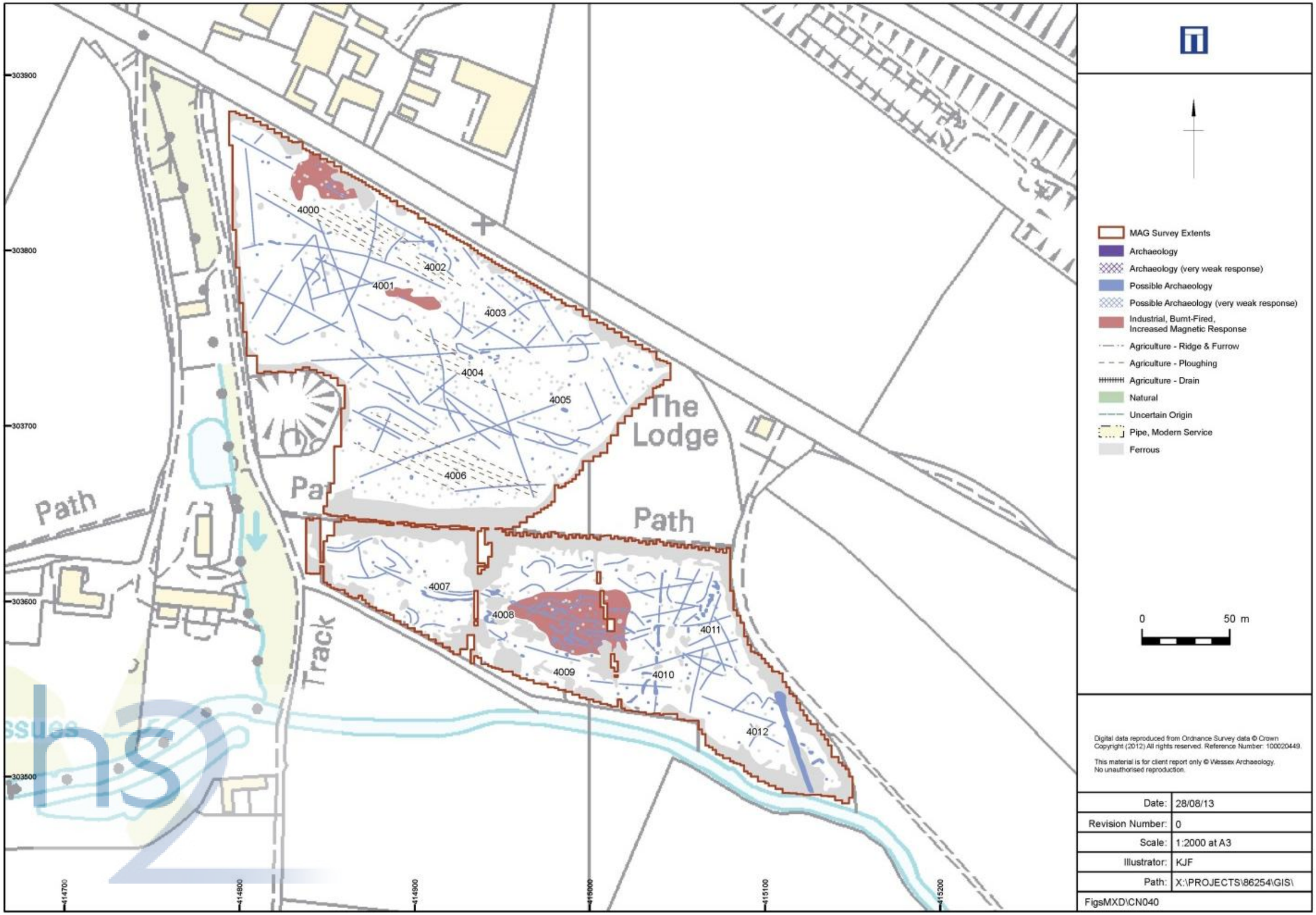


Figure 14: XY trace

Figure 15: Interpretation



3.3 CN043 Land off Tamworth Road (A51), near Lichfield, Staffordshire

Introduction

Project Background

3.3.1 Wessex Archaeology was commissioned by Atkins, on the behalf of HS2, to carry out a geophysical survey of area CN043 off Tamworth Road (A51), near Lichfield, Staffordshire (Figure 16), hereafter "the Site" (centred on NGR 414600 307050). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.

3.3.2 This Site, CN043, was selected for geophysical survey as it is located close to known archaeological remains. It is considered to be an area at medium risk (risk model score: 3).

3.3.3 For a detailed assessment of the known archaeology of the Site and surrounding area Appendix CH-001-021 should be consulted.

Site details

3.3.4 The Site comprises a single arable field located off Tamworth Road (A51) opposite the Whittington Heath golf course and 700m northwest of Whittington Barracks. The Site lies approximately 3.8km southeast of the centre of Lichfield. The limits of the geophysical survey area are defined by the boundaries enclosing this field. The majority of the Site was in the process of being ploughed when the geophysical survey took place; a large portion of the site to the north was covered by a fodder crop. Geophysical survey was undertaken over the roughly ploughed area of the site with the area of fodder crop excluded from survey due to concerns that the long vegetation might impact on data quality. The area of data coverage came to around 10.1ha with a further 3.6ha left to survey under the fodder crop.

3.3.5 The Site lies on an area of very gently sloping land that falls away towards the southwest; the land slopes downwards more steeply close to the southwest corner. The majority of the survey area to the northeast lies at a height of around 100m aOD (above Ordnance Datum) and falls from this height to around 95m aOD in the southwest corner. The Site occupies one of the highest areas of a ridge running northwest to southeast; the highest point is located at the nearby Whittington Barracks (107m aOD). Several watercourses define this ridge of land; the River Tame to the east (roughly aligned north to south), a small unnamed brook that flows towards the north to the west of the Site and Brook Leasow to the southeast of the Site that flows northeast to the River Tame.

3.3.6 The solid geology is recorded as Keuper Sandstone (Triassic) under the southwestern half of the Site and Bunter Sandstone (Triassic) under the northeastern half of the site (Ordnance Survey 1957). There are no superficial deposits recorded across the Site although glacial deposits (Quaternary) are recorded as present nearby (Ordnance Survey 1977).

3.3.7 The soils underlying the Site are likely to be typical brown sands of the 551a (Bridgnorth) association. There are other soil types nearby with typical brown earths of the 541r (Wick 1) association to the north and typical humic-sandy gley soils of the 861b (Isleham 2) association to the west of the Site (SSEW 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

Methodology

Survey Objectives

3.3.8 A Written Scheme of Investigation (WSI) was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed (Wessex Archaeology 2013). The stated aims include the following:

- to conduct a detailed survey which covers as much of the specified area as possible, allowing for artificial obstructions;
- to clarify the presence/absence and extent of any buried archaeological remains within the site; and
- to determine the general nature of the remains present.

3.3.9 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.

Survey Dates

3.3.10 A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team between 28th and 31st May 2013.

Grid Location

3.3.11 The individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (EH 2008).

3.3.12 A representative sample of survey grid nodes (around 10%) were re-surveyed in the mornings in the event they were left out in the field overnight. This was undertaken along with a visual inspection of entire lines of grid nodes to ensure the survey grid remained accurate for the entire survey.

Instruments Used and Survey Method

3.3.13 The magnetometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data were collected at 0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT, in accordance with EH guidelines (EH 2008).

3.3.14 Data were collected in the zigzag method with grids oriented north to south (Grid North). The first direction walked for each grid was heading towards the north.

Data Processing

3.3.15 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse function (±5nT thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. The multiply function was applied to selected grids to balance differences in background texture that resulted from collecting some data with the sensors closer to the ground. These three steps were applied to all survey data, with no interpolation applied.

3.3.16 Further details of the geophysical and survey equipment, methods and processing are described in Appendix 1.

Data Presentation

3.3.17 The processed gradiometer data were output as .png image files and georeferenced in CAD (AutoCAD Map 3D 2011); these images were exported as georeferenced .png image files (accompanied by .pgw files). The interpretation layers were digitised in CAD and the resulting interpretation layers were exported as ESRI shapefiles, in accordance with the specification. The data images and interpretation shapefiles were then passed to our graphics team who produced the final figures in GIS (ESRI ArcMap 10).

3.3.18 The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ±25nT at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:1500.

Results

Introduction

3.3.19 The gradiometer survey has been successful in identifying anomalies of possible archaeological interest, along with numerous trends and a couple of modern services. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1500 (Figure 17 to Figure 19).

3.3.20 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Figure 19). Full definitions of the interpretation terms used in this report are provided in Appendix 2.

3.3.21 Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

Interpretation: Archaeology

3.3.22 The greatest concentration of anomalies of possible archaeological interest lies in the southwest corner of the Site. The wider area around these anomalies has been defined as natural given the wide spread of weak bipolar (black and white) anomalies visible in the background. However, these discrete positive anomalies are much stronger with magnetic values exceeding +3nT. Most of these anomalies have an irregular shape in plan but a few have some regularity in form with squared and L-shaped anomalies observed around 4000 and 4001 in particular. Due to the apparent spread of natural features within the vicinity and the irregularity in form of some of these positive anomalies they have all been termed possible archaeology. If archaeological, these features are considered to represent cut features such as pits. There are more positive anomalies outside of this spread that may prove to be archaeological such as at 4002 and 4003.

3.3.23 The feature at 4002 is made up of two positive anomalies that appear to form a very short linear feature measuring approximately 7m in length; it is aligned northwest to southeast. There are two other similarly aligned short linear features located approximately 50m to the east of this one. These features may prove to be cut features such as short sections of ditch but could just as easily represent strong ploughing features. They have been termed possible archaeology due to the uncertainty in their interpretation.

3.3.24 The feature at 4003 is represented by a sub-oval shaped positive anomaly measuring approximately 3m in length. It has magnetic values between +2nT and +4nT and is considered to possibly represent a cut feature such as a small pit. This feature represents one of the larger examples but there are a great many of similar shape with similar magnetic values located across the site. Not all of these are considered to be archaeological and many are likely to be natural features such as tree throws. However, past experience has shown it is not easy to pick out genuine archaeological features from strongly magnetised natural features such as tree throws. Due to the uncertainty in interpretation all of these positive anomalies have been classed as possible archaeology. There are a few groups of positive anomalies that appear to form significant patterns in their spatial distribution; these will be discussed below.

3.3.25 Two services were observed at 4004 and 4005; these will be discussed in greater detail in the next section of the report.

3.3.26 Along with the numerous small positive anomalies present across the site are a number of linear and curvilinear trends classed as uncertain origin. Many of these trends may prove to be related to modern ploughing but some may prove to be of archaeological significance. There are a group of small positive anomalies at 4006 that form a slightly irregular arc. Similarly there are regular trends that form right-angles and curved arcs around 4007 and 4008. These features could be a coincidental arrangement of unrelated anomalies or in some cases could simply be a curved plough scar created when the tractor made a turn.

3.3.27 The majority of the trends observed were fairly straight and were aligned parallel to the present field boundaries such as can be seen around 4009. These have been classed as ploughing trends and are considered to be relatively modern.

3.3.28 There are two spreads of dipolar and bipolar anomalies at 4010 and 4011; these have been classed as industrial, burnt-fired, increased magnetic response. Given their magnetic values and their close proximity to modern services it is considered that these spreads represent a concentration of relatively modern ferrous and ceramic debris.

3.3.29 The remaining features present on site are broad, irregular shaped spreads of weak bipolar anomalies. These spreads, such as 4012, are not consistent with a spread of magnetised anthropogenic material (ferrous/ceramic). These spreads are considered to be natural and variations in the underlying geology are considered to be a likely cause.

Interpretation: Modern Services

3.3.30 Two modern services have been identified in the data at 4004 and 4005; the service at 4004 does not appear to be complete with wide gaps at two points along its length. The other service at 4005 appears to be complete. Both services are considered to represent metallic/ceramic pipes.

3.3.31 It is not clear from the geophysical data whether the services identified are in active use or not. Also gradiometer data will not be able to locate and identify all services present on site. This report and accompanying illustrations should not be used as the sole source for service locations and appropriate equipment (e.g. CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on site.

Conclusions

Introduction

3.3.32 The detailed gradiometer survey has been successful in detecting anomalies of possible archaeological interest within the Site, in addition to regions of increased magnetic response, numerous trends and a couple of modern services.

Discussion

3.3.33 No anomalies of definite archaeological interest have been identified in the geophysical data. There were no groups of anomalies that produced a significant enough pattern in their spatial distribution to warrant classification as definite archaeology. That said there are some areas of the dataset that may prove to be more interesting such as around 4000 and 4001 where high concentrations of positive magnetic anomalies were detected. Also some of the trends and small positive anomalies such as 4003 and 4006 may prove to be significant.

3.3.34 No anomalies of definite archaeological interest have been identified in the geophysical data. There were no groups of anomalies that produced a significant enough pattern in their spatial distribution to warrant classification as definite archaeology. That said there are some areas of the dataset that may prove to be more interesting such as around 4000 and 4001 where high concentrations of positive magnetic anomalies were detected. Also some of the trends and small positive anomalies such as 4003 and 4006 may prove to be significant.

3.3.35 It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be encountered than have been identified through geophysical survey.

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Figures

Figure 16: Site location

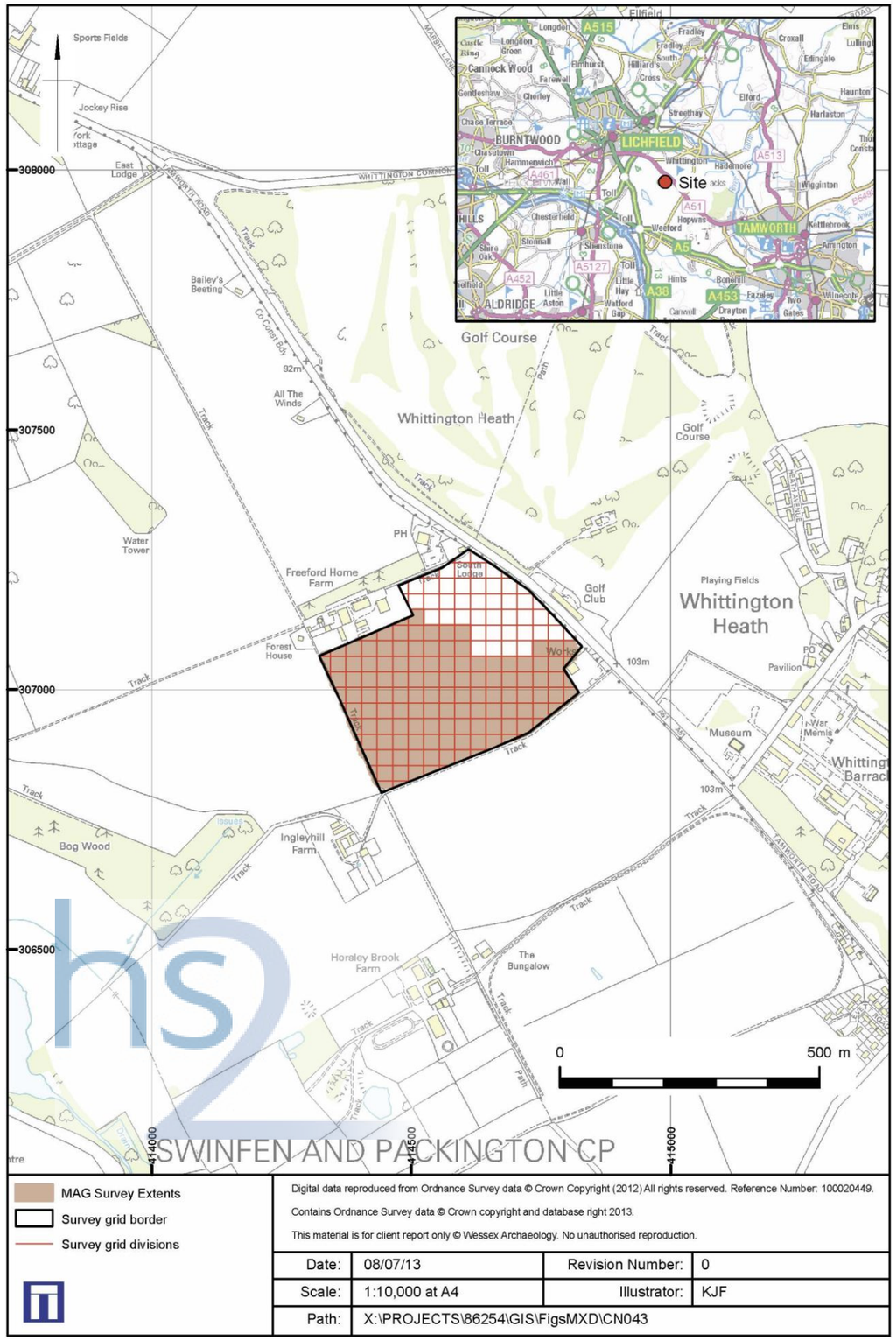


Figure 17: Greyscale plot

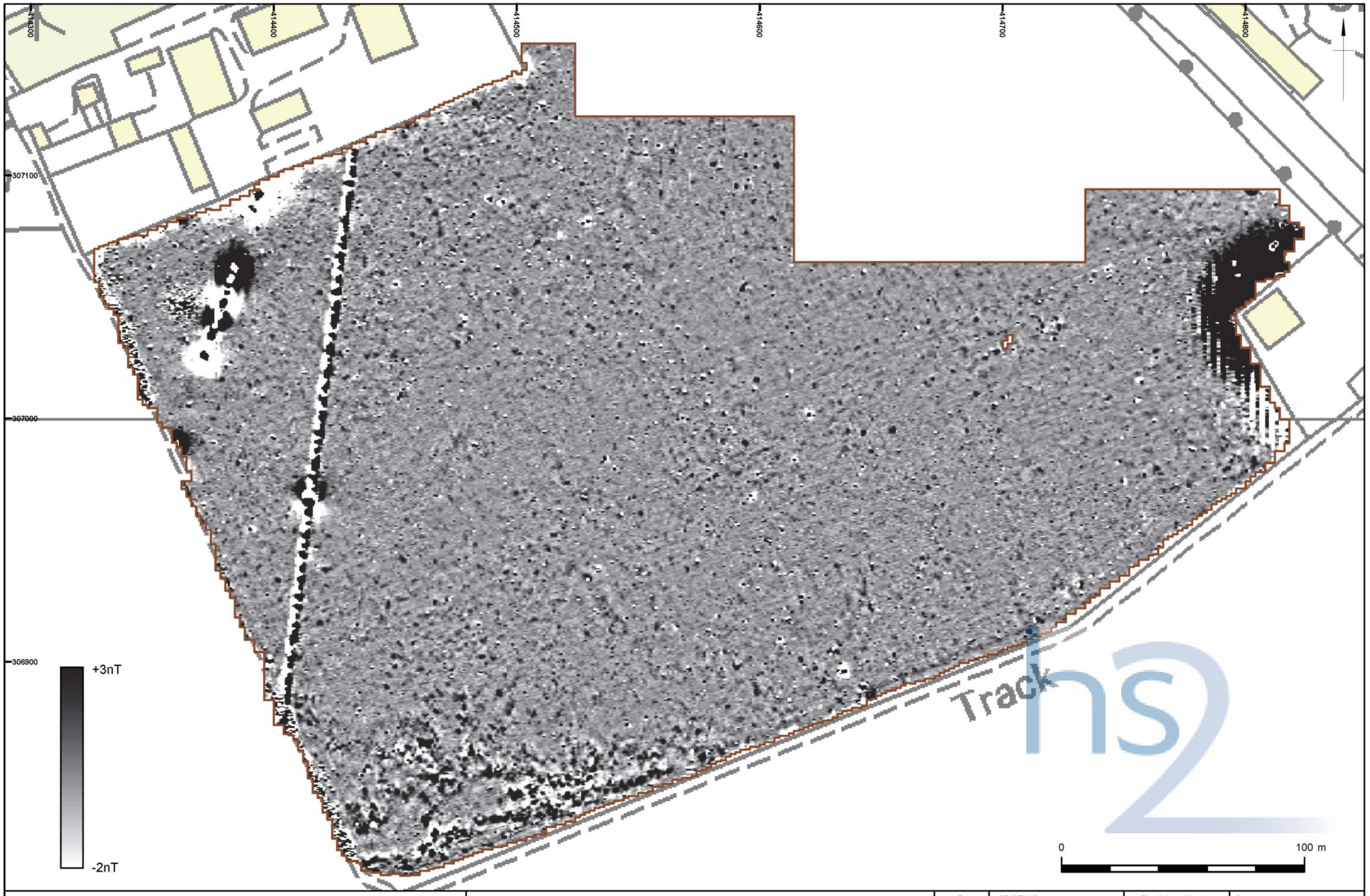


Figure 18: XY trace

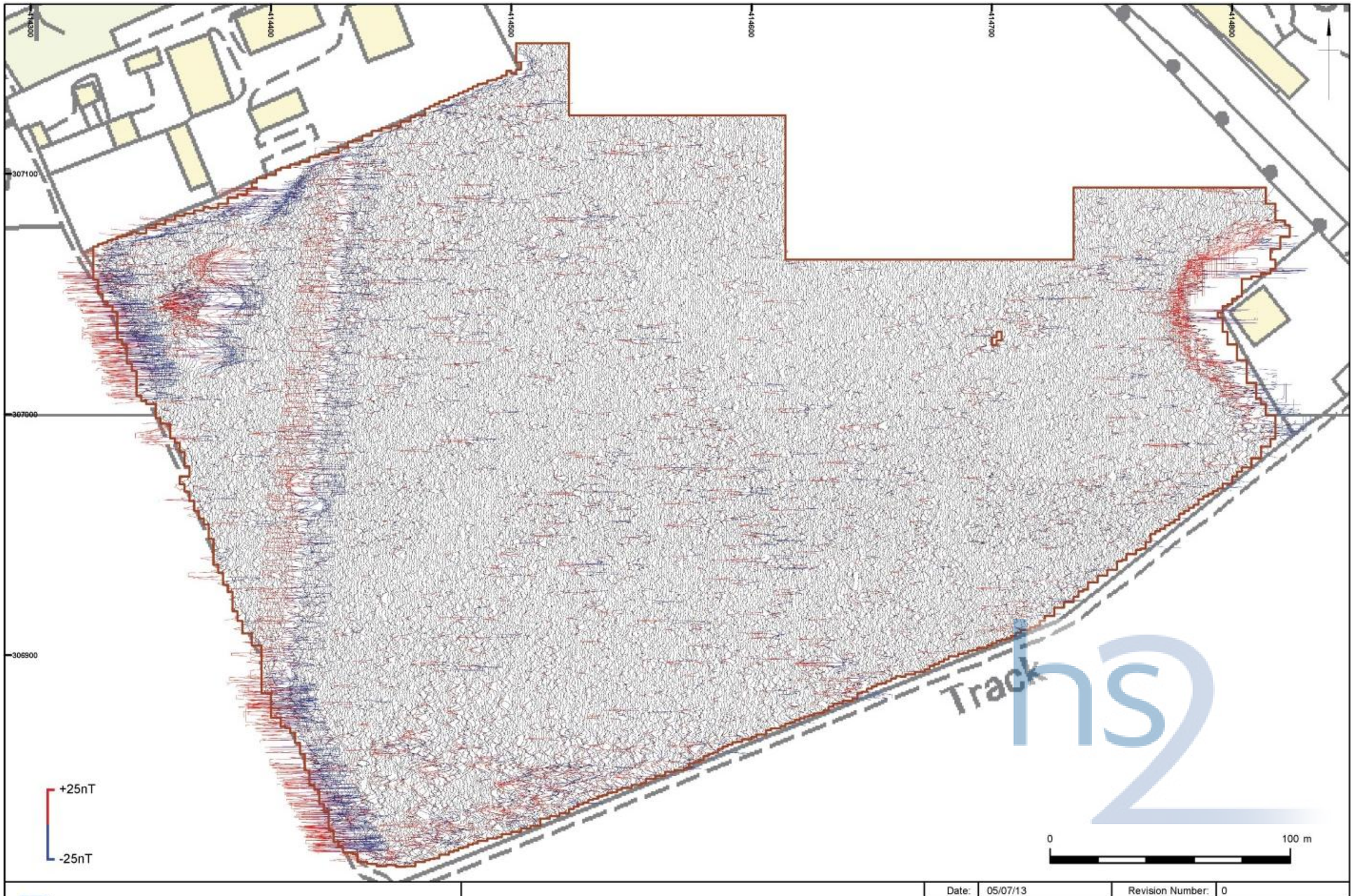
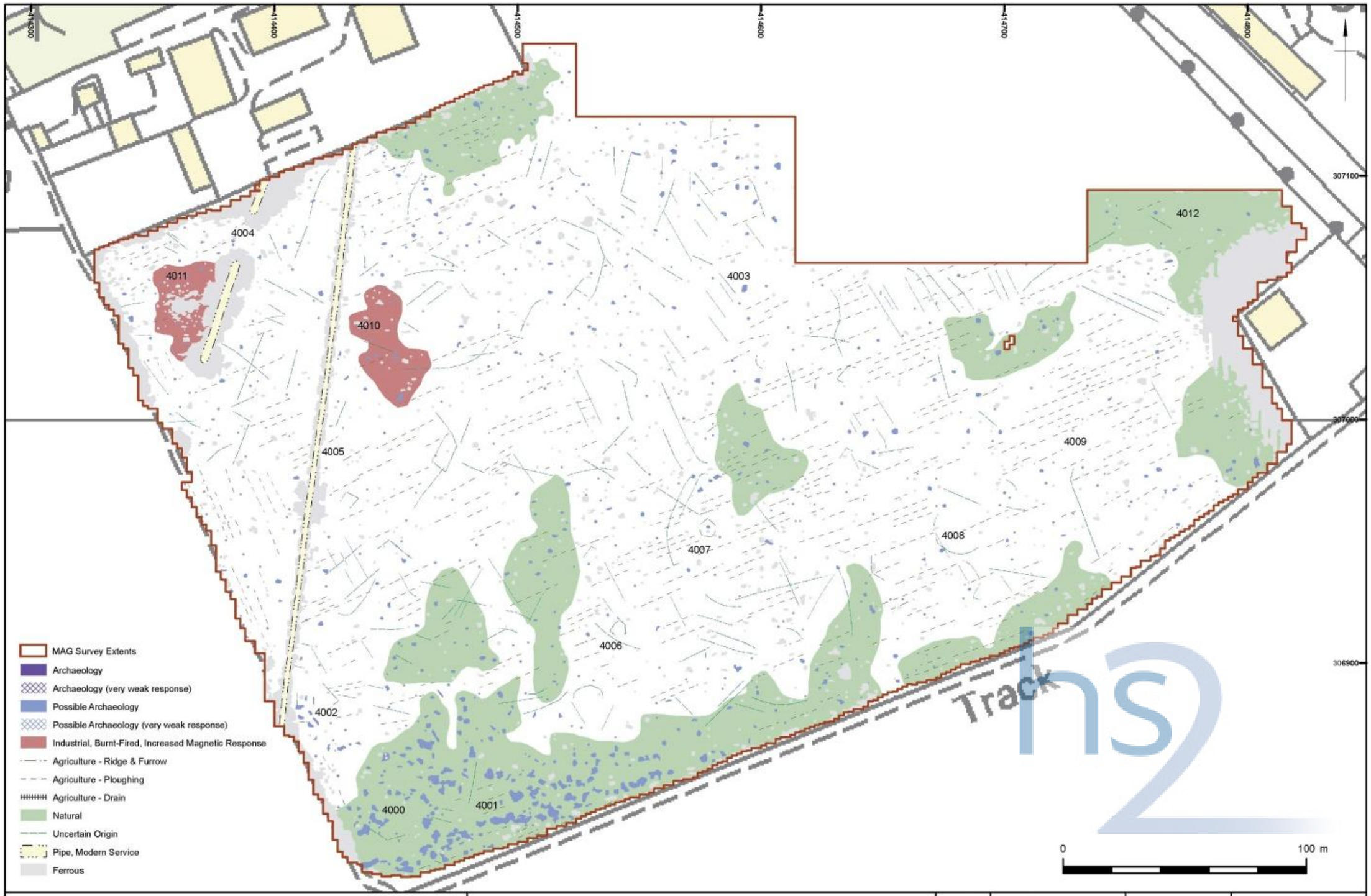


Figure 19: Interpretation



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3.4 Appendix 1. Survey Equipment and Data Processing

Survey Methods and Equipment

3.4.1 The magnetic data for this project was acquired using a Bartington 601-2 dual magnetic gradiometer system. This instrument has two sensor assemblies fixed horizontally 1m apart allowing two traverses to be recorded simultaneously. Each sensor contains two fluxgate magnetometers arranged vertically with a 1m separation, and measures the difference between the vertical components of the total magnetic field within each sensor array. This arrangement of magnetometers suppresses any diurnal or low frequency effects.

3.4.2 The gradiometers have an effective resolution of 0.03nT over a ±100nT range, and measurements from each sensor are logged at intervals of 0.25m. All of the data are stored on an integrated data logger for subsequent post-processing and analysis.

3.4.3 Wessex Archaeology conducts detailed gradiometer surveys using an accurate 20m or 30m site grid, which is achieved using a Leica Viva RTK GNSS instrument and then extended using tapes. The Leica Viva system receives corrections from a network of reference stations operated by the Ordnance Survey and Leica Geosystems, allowing positions to be determined with a precision of 0.02m in real-time and therefore exceed the level of accuracy recommended by English Heritage (2008) for geophysical surveys.

3.4.4 The detailed surveys consist of 20m x 20m or 30m x 30m grids, and data are collected at 0.25m intervals along traverses spaced 1m apart. These strategies give 1600 or 3600 measurements per 20m or 30m grid respectively, and are the recommended methodologies for archaeological surveys of this type (EH 2008).

3.4.5 Data may be collected with a higher sample density where complex archaeological anomalies are encountered, to aid the detection and characterisation of small and ephemeral features. Data may be collected at up to 0.125m intervals along traverses spaced up to 0.25m apart, resulting in a maximum of 28800 readings per 30m grid, exceeding that recommended by English Heritage (2008) for characterisation surveys.

Post-Processing

3.4.6 The magnetic data collected during the detail survey are downloaded from the Bartington system for processing and analysis using both commercial and in-house software. This software allows for both the data and the images to be processed in order to enhance the results for analysis; however, it should be noted that minimal data processing is conducted so as not to distort the anomalies.

3.4.7 As the scanning data are not as closely distributed as with detailed survey, they are georeferenced using the GPS information and interpolated to highlight similar anomalies in adjacent transects. Directional trends may be removed before interpolation to produce more easily understood images.

3.4.8 Typical data and image processing steps may include:

- Destripe – Applying a zero mean traverse in order to remove differences caused by directional effects inherent in the magnetometer;
- Destagger – Shifting each traverse longitudinally by a number of readings. This corrects for operator errors and is used to enhance linear features;
- Despike – Filtering isolated data points that exceed the mean by a specified amount to reduce the appearance of dominant anomalous readings (generally only used for earth resistance data);
- Deslope – This function is used to remove a linear trend within a data set. It is most commonly used to remove grid edge discontinuities that can result from applying zero mean traverse to a data set.
- Multiply – The multiply function multiplies the data by a negative or positive constant value. It has a variety of functions but its typical use is to normalise data that has been collected with sensors at different heights from the ground.

3.4.9 Typical displays of the data used during processing and analysis:

- XY Plot – Presents the data as a trace or graph line for each traverse. Each traverse is displaced down the image to produce a stacked profile effect. This type of image is useful as it shows the full range of individual anomalies.
- Greyscale – Presents the data in plan view using a greyscale to indicate the relative strength of the signal at each measurement point. These plots can be produced in colour to highlight certain features but generally greyscale plots are used during analysis of the data.

3.5 Appendix 2: Geophysical Interpretation

Interpretation Categories

3.5.1 The interpretation methodology used by Wessex Archaeology separates the anomalies into two main categories: archaeological and unidentified responses.

3.5.2 The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided into three groups, implying a decreasing level of confidence:

3.5.3 Archaeology – used when there is a clear geophysical response and anthropogenic pattern.

3.5.4 Possible archaeology – used for features which give a response but which form no discernible pattern or trend.

3.5.5 The unidentified category is used for features when the form, nature and pattern of the anomaly are not sufficient to warrant a classification as an archaeological feature. This category is further sub-divided into:

- Industrial, Burnt-Fired, Increased magnetic response – used for areas dominated by bipolar and dipolar anomalies which may have some archaeological potential.
- Uncertain Origin – used for low amplitude or indistinct linear anomalies.
- Ferrous – used for responses caused by ferrous material. These anomalies are likely to be of modern origin.
- Agricultural – used for linear trends that can be shown to relate to agricultural activity including ridge and furrow, drainage and ploughing scars.

- Natural – used for spreads of anomalies that are considered to be geological or more discrete anomalies considered to be natural.

3.5.6 Finally, services such as water pipes are marked where they have been identified along with ceramic field drains.